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HISTORY OF **ENDEMIC** HAWAIIAN BIRDS

Part I. POPULATION HISTORIES--SPECIES ACCOUNTS
Sea Birds: Newell Shearwater ('A'o)

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ABSTRACT

Puffinus puffinus newelli is a stout, medium-sized shearwater with dark upperparts and light underparts. It was first described in 1894. Exhaustive search uncovered some 204 observations, collection records, reports and related statements on relative abundance and geographical distribution from 1887 to 1978. All data are arranged in geographical and chronological order and systematically analyzed. Distribution at-sea and outside expected range (extra-limital) are given. Numbers of island records are shown by U. S. Geological Survey quadrangle. References and names of observers are cited. Completeness of data, erroneous and doubtful records are addressed. Findings are summarized. It is concluded that only **a** small fraction of the once-large population is presently extant and that the future of this subspecies **as** part of the world's living avifauna cannot be viewed with optimism if the sole remaining colonies (on Kaua'i) continue their apparent decline.

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1. Puffinus puffinus newelli
 'A'o or Newell Shearwater
 (a subspecies of Manx Shearwater)

The 'A'o or Newell Shearwater (Puffinus puffinus newelli) is one of the eight subspecies of Manx Shearwater, a species of world-wide distribution (Murphy 1952). King (1967) and Berger (1972) give general descriptive accounts of the 'A'o, characterizing it as a medium-sized, 12 to 14 inch long, stout shearwater with short wings, dark upperparts, white underparts, and short rounded tail. The 'A'o may be distinguished most easily from the 'Ua'u (Pterodroma phaeopygia sandwichensis)--the only other similar inland breeding species--by its black, rather than white, forehead. During the breeding season which extends from May to October, the 'A'o is usually found at sea within 200 miles of the Hawaiian Islands. Like the 'Ua'u, the 'A'o flies over land only at night, nesting in burrows in the mountains sometimes miles from the ocean. Discovery of a major breeding colony of 'A'o on the island of Kaua'i, including description of night-calling, is given by Sincock and Swedberg (1969). Most of a total of 47 specimens located in a recent world-wide survey of museums were found in the U. S. National Museum of Natural History (36), Bernice P. Bishop Museum (4), and Yale University Peabody Museum (2) (Banko 1978 ms.).

OBSERVATIONS, REPORTS, AND SPECIMEN RECORDS

Drawing conclusions from a large volume of historical information on relative abundance and distribution of 'A'o required that data be geographically arranged and chronologically ordered in a systematic fashion, as outlined in the Introduction to Part I (CPSU/UH Avian History Report 4). Records presented in Appendix I satisfy criteria necessary for basic documentation and comparative analysis.

In the following descriptive account, sources of published information are cited by author and year in the usual style. One, two, or three digit numbers in parentheses refer to specific records in Appendix I. Sources of published and unpublished information listed in Appendix I may be traced to complete references in the bibliography.

Early Records (ca.1890-1915):

According to Henshaw (1900, 1902), several specimens of 'A'o, including the type, were obtained by native Hawaiians at Waihe'e Valley, Maui, in the spring of 1894 where the species was reported **as** numerous (1, 151, 152). The status of the population

in the type locality was termed "doubtful" by Henshaw, though he still observed them to be numerous during that period in the channel between Maui and Moloka'i (153, 188). Perkins (1903) acknowledged the occurrence of 'A'o on Maui, Kaua'i, Moloka'i, and other islands with deep valleys and precipitous sides during the same period (2).

Bryan and Seale (1901), Munro (1941), and King (1967) state that specimens of 'A'o were taken on Kaua'i by Francis Gay, who reported them to be nesting near the sea and in certain cliffs in the mountains ca. 1891 (16, 17, 18). 'A'o were noted at sea in sight of Kaua'i by Munro (1944) on 14 August 1891 (187). Bryan (1915) secured specimens of 'A'o on Kaua'i in 1915, observing them to be nesting at lower elevations than 'Ua'u (4).

On Moloka'i, Perkins (1903) found several dead and partially decayed specimens after a severe storm at the head of one of the deep valleys in the 1890's (146). Bryan (1908) found 'A'o occasionally in the same colony as 'Ua'u (147), much rarer than 'Ua'u in the valleys of Wailau and Pelekunu, though informed by the natives that their young could still be collected in considerable numbers from the steepest parts of the cliffs at Pelekunu (148, 150). Some years previously, Bryan obtained a specimen on one of the steep cliffs toward the summit of the mountain between Pelekunu and Waikolu (147).

On the island of Hawai'i, Munro (1944) reported that 'A'o were eaten by natives in Waipi'o Valley about the turn of the century (161, 162).

There seem to have been no records, observations, or specimens of this bird preserved during the period 1916 to 1943.

Later Records (1944-1978):

Munro (1944) believed the 'A'o, "formerly common" on Hawai'i, Maui, Moloka'i, Kaua'i, and "probably other smaller islands," to be in danger of extinction (3). Fisher (1951) saw three flying in the channel between Kaua'i and Ni'ihau sometime between 11 to 17 August 1947 (189). Four specimens were taken on Kaua'i in 1956, one by an anonymous reporter (1956) on the beach at Kapa'a during the forepart of October (79); one by J. Bowles at Kilauea Point on 5 November (59) (King 1967); and two by G. C. Munro--one on 11 May at an undisclosed locality (King 1967) and one on 8 October at Kōloa (Banko 1978 ms.) (19, 107). It must have been about this period that R. Fuller found burrows and dead 'A'o not too far away from the Māhā'ulepū area, according to G. E. Swedberg (108).

Kaua'i

In the summer of 1960, while conducting a general ornithological survey of Kaua'i, Richardson and Bowles (1964) found six disabled or dead 'A'o in the Wailau and Kapa'a areas, salvaging

two as specimens (79-83). They also observed, just before dark on a number of nights, one to six flying high overhead near Kapa'a along the coast or headed inland, leading them to conclude that a sizable breeding population was present in the distant mountains, though they found no clues as to location (20, 84). In October 1960, Hadley (1961) counted a total of 48 "shattered" shearwaters, presumably 'A'o, along five miles of the highway skirting the shoreline between Keālia and the Wailua River, reporting "never was there such a slaughter as last month...eight under one street lamp at a crossing and...ten more within a hundred yards" (85).

The year 1960 apparently marked the beginning of 'A'o crashes which occurred with varying intensity during subsequent years along the entire inhabited coastline of Kaua'i. G. E. Swedberg and T. C. Telfer (biologists, Hawaii State Division of Fish & Game); J. L. Sincock (research biologist, U. S. Fish & Wildlife Service); and W. B. King (ornithologist, Smithsonian Institution) witnessed different aspects of this unexpected phenomenon over a period of several years. **Most** of the early reports and records of this now annual event are contained in an extensive account of the 'A'o by King and Gould (1967). Corroborating observations were recorded by Anonymous (1968), Donaghho (1965, 1968), Doughty (1972), Hansen (1975), Kaigler (1970), and Ord (1963) (46, 48, 55, 68, 69, 120, 136, 151, 153).

Judging from the combined record of some 96 observations and records of specimens by Swedberg, Telfer, Sincock, and King from 1961 to 1974 (39-45, 47, 49-54, 56, 59-67, 70, 74-78, 80-82, 86-105, 107-119, 121-135), the following points seem evident:

1. 'A'o were probably recently present in moderate numbers in most of the valleys, leading to a 1966 population estimate of at least the low thousands.
2. Crashing is a relatively recent event, beginning ca. 1960.
3. Crashes occur most frequently on northeast, east, and southeast parts of Kaua'i, from about April until November, peaking in October just before 'A'o leave for wintering areas.
4. Both adults and young-of-the-year crash,
5. Of several hundred 'A'o which have been banded and released, few if any bands had been returned by 1974.
6. Most crashes occur in the vicinity of bright lights.
7. 'A'o which crash appear emaciated and exhausted; some recover after being picked up, others die.

8. Crashing 'A'o have been observed to simply fall out of the air, without striking any object.
9. Estimates of numbers which die after crashing range from 200 or more during 1962 to 1966, to 399 to 500 during 1968 to 1973. As many as 200 have been picked up in a 3-week period around a single light source (22 Oct. to 11 Nov. 1967).
10. Total population appears to be declining, apparently as a result of crashing.
11. Basic cause of crashing appears to be lack of energy resources. Bright lights may be a contributory factor.

Zeillemaker (1975a, 1975b) and Pyle (1978) reported crashing after 1974 (71, 72, 100, 106, -33). The U. S. Fish and Wildlife Service (1975) stated that 'A'o were thought to be restricted to an isolated part of Kaua'i and number in the thousands (32). A major breeding colony, 30 nesting burrows and possibly more than 500 individuals heard, were discovered on a ridge of Makaleha Mountains by Sincock and Swedberg (1969) (67).

O'ahu

Fourteen grounded 'A'o, some dead, have been picked up on O'ahu from May to November in the 20-year period 1954 to 1975, five in 1967 alone (Richardson 1955) (Hatch 1959) (Carpenter et al. 1962) (King 1967) (Swedberg 1968) (Sincock & Swedberg 1969) (Kridler, Swedberg, & Conant, pers. comm.). Crashes have occurred from 'Aiea to Honolulu, especially near the Pali tunnel (138-145b). No evidence of 'A'o breeding on O'ahu has been uncovered.

Hawai'i

Based on information in Munro (1944) that 'A'o once occurred in Waipi'o Valley, I carried out searches along the crest of the Kohala Mountains in 1967 and 1968, but these proved fruitless (156-160). Night-calling of 'A'o was, however, reported later at two lower elevation locations in the windward Kohala Mountains by Hall (1978) and Collins (Kepler et al. 1978 ms.) (154, 155).

Calling of night-flying 'A'o headed upslope over Honomalino farms in South Kona was reported to me by local residents from May to September in 1970, 1971, and 1972 (164-170). According to one report (164), numbers of calling 'A'o have declined in recent years. I identified one bird which crashed after striking a residential TV antenna as Puffinus puffinus newelli (163).

In Hawaii Volcanoes National Park, a U. S. Geological Survey field party discovered the partly burned carcass of a sea bird, and an egg, after a 4 August 1972 volcanic eruption at Makaopuhi Crater (173). Tentative identification of the carcass retrieved by D. W. Peterson as P. p. newelli was confirmed later at the U. S. National Museum by R. Laybourne. I heard a few 'A'o calls in the same area the following month (174, 175). P. H. Baldwin (pers. comm.) thought it reasonable that the apparent small residual 'A'o population at Makaopuhi had been overlooked earlier (176). However, 'A'o were not heard at Makaopuhi Crater during a two-hour vigil on a windy, rainy night in August 1978 (176a).

In April 1970, W. A. Larson reported seeing two 'A'o off-shore of National Park Service residences at Kalapana (199). R. and C. Yutzy reported seeing 'A'o seaward of Harry K. Brown Park, Waha'ula Visitor Center, and Kamoamoa, Hawaii Volcanoes National Park in August 1975 (200-202).

'A'o are occasionally heard, glimpsed, or picked up after crashing around bright lights at low elevations along the Hāmākua Coast, from Hilo to Laupāhoehoe. 'A'o which crashed in Hilo were picked up and/or identified by me in 1968, E. Kosaka in 1970, and S. Conant in 1978 (182-186a). Kepler, Jeffrey, and Scott (1978 ms.) (1979) reported on singles and small groups of 'A'o heard or seen in transit, or picked up dead, along the Hāmākua Coast near Laupāhoehoe, Ka'uku Crater, Hakalau River, Pāpa'ikou-Pepe'ekeo Hill, and Wailuku River (177-181, 183, 184).

Distribution At Sea

Except for previously mentioned observations of 'A'o off-shore near Kaua'i, Moloka'i, and Maui (187, 188), and sighting by Fisher (1951) of three in the channel between Kaua'i and Ni'ihau in August 1947 (189), nothing was known of the pelagic distribution of 'A'o until the Smithsonian Institution's wide-ranging Pacific Ocean Biological Survey Program was carried out in the middle and late 1960's. Trained biologists in this program recorded distribution and relative abundance of all species of sea birds during 3561 hours of observation on 15 cruises along a predetermined replicated sampling track of 34,384 miles in the general vicinity of the Hawaiian Islands. From 'A'o identified on these cruises, and 17 specimens collected, King (1970), who reported results of this work, concluded that during the May to October 1964-1965 study period most of the population was to be found either fairly close to the Hawaiian Islands or roughly 400 miles south of the island of Hawai'i, at the southern edge of the 500,000 square mile study area, though a few individuals were noted up to 800 miles away to the southeast of O'ahu (190-194). Two density centers were found, one within 200 miles north of O'ahu and one at the southern end of the cruise tracks below 14°N latitude (195). Beginning in October, 'A'o were found to migrate, presumably to the west and south, to an unknown wintering area, being nearly absent from the Hawaiian waters during winter (King 1967) (196-198).

Extra-limital

Three specimen records (203-205) establish the occasional presence of the species on islands far to the west and south of Hawai'i, in the Mariana Islands (May 1887) (Jouanin 1956); and on Johnston Atoll (August 1963) and Wake Atoll (June 1966) (Banko 1978 ms.), where their presence so far outside of their normal range during the breeding season may be tentatively taken as extra-limital.

COMPLETENESS OF DATA, ERRONEOUS AND DOUBTFUL RECORDS

Data on relative abundance and geographical distribution of 'A'o presented herein are believed essentially complete for the sources examined, from 1887 until the contemporary period. John Sincock, U. S. Fish and Wildlife Service biologist, has studied the species on Kaua'i since about 1967. Others have undoubtedly collected much important data. All such information will hopefully be published soon.

Attention is drawn to three apparent cases of mistaken identification of 'A'o which have either not been credited at all in this report or not credited as previously cited. Munro (1944), in passing along information received from W. H. Meinecke that 'A'o formerly nested at Pali Puao near Wai'ōhinu, Ka'ū, island of Hawai'i, may have confused identity of 'A'o with that of 'Ua'u (Pterodroma phaeopygia sandwichensis) (171, 172). Pearsall (1947) reported an adult 'A'o with chick at Kīlauea Point, Kaua'i, in July 1946. But this is doubtful, particularly in the light of Fennel's (1947) fruitless search during the breeding season the following year (57, 58), and lack of further observations. Pearsall probably confused the identity of 'A'o with that of Wedge-tailed Shearwaters (Puffinus pacificus chlrorhynchus) which nest at Kīlauea. Lastly, Warner's (1968) report of sea birds grounded along the windward beaches of Kaua'i during the summers of 1960 and 1961 confused the identity of 'A'o with that of 'Ua'u (R. E. Warner, pers. comm.). Circumstantial evidence and lack of further similar incidents involving 'Ua'u supports Warner's subsequent belief that the birds seen both years were 'A'o, not 'Ua'u as stated.

CHRONOLOGICAL DISTRIBUTION OF RECORDS

Of some 205 'A'o records, 204 were classified according to decade of origin and compiled in Table 1. The numbers in the table exhibit the initial observations following description of the species in the 1890's, the comparative absence of reports from the early 1900's through the 1930's, and the explosion of observations on Kaua'i after crashing on that island was first noticed about 1960. The downward trend of records from Kaua'i

from the 1960's to the 1970's apparently reflects lack of reporting more than decline in crashing.

TABLE 1. Distribution of 204 'A'o records by decade.

1770's -	1840's -	1910's - 1
1780's -	1850's -	1920's -
1790's -	1860's -	1930's -
1800's -	1870's -	1940's - 4
1810's -	1880's - 1	1950's - 6
1820's -	1890's - 7	1960's - 125
1830's -	1900's - 11	1970-8 - 49

GEOGRAPHICAL DISTRIBUTION OF RECORDS

Distribution of all positive observations, reports, and specimen records--except at-sea and extra-limital records--are shown for each quadrangle for the islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i in Figures 1 and 2. There seem to be no records of 'A'o occurrence on Ni'ihau, Lāna'i, and Kaho'olawe, the small offshore islets of the five major islands, or on the Northwestern Hawaiian Islands.

SUMMARY

Characterized by dark upperparts, white underparts, short wings and tail, the 'A'o or Newell Shearwater (Puffinus puffinus newelli) is one of eight subspecies of the stout, ~~medium-sized~~ Manx Shearwater. The 'A'o is found at sea principally within 200 miles of the Hawaiian Islands during its May to October breeding season, flying over land only at night to nest in burrows in the mountains.

On the island of Kaua'i, 'A'o specimens were collected from about 1890 to 1915 when it was noted to be fairly common, nesting on precipitous slopes near the sea. After a gap of 40 years during which no specimens were taken, four examples were secured again in 1956. In 1960 'A'o began to be observed flying inland at dusk and to occasionally crash around brightly lighted areas along the inhabited coast at night. Subsequent surveys found night-flying individuals frequenting most of the inland valleys,

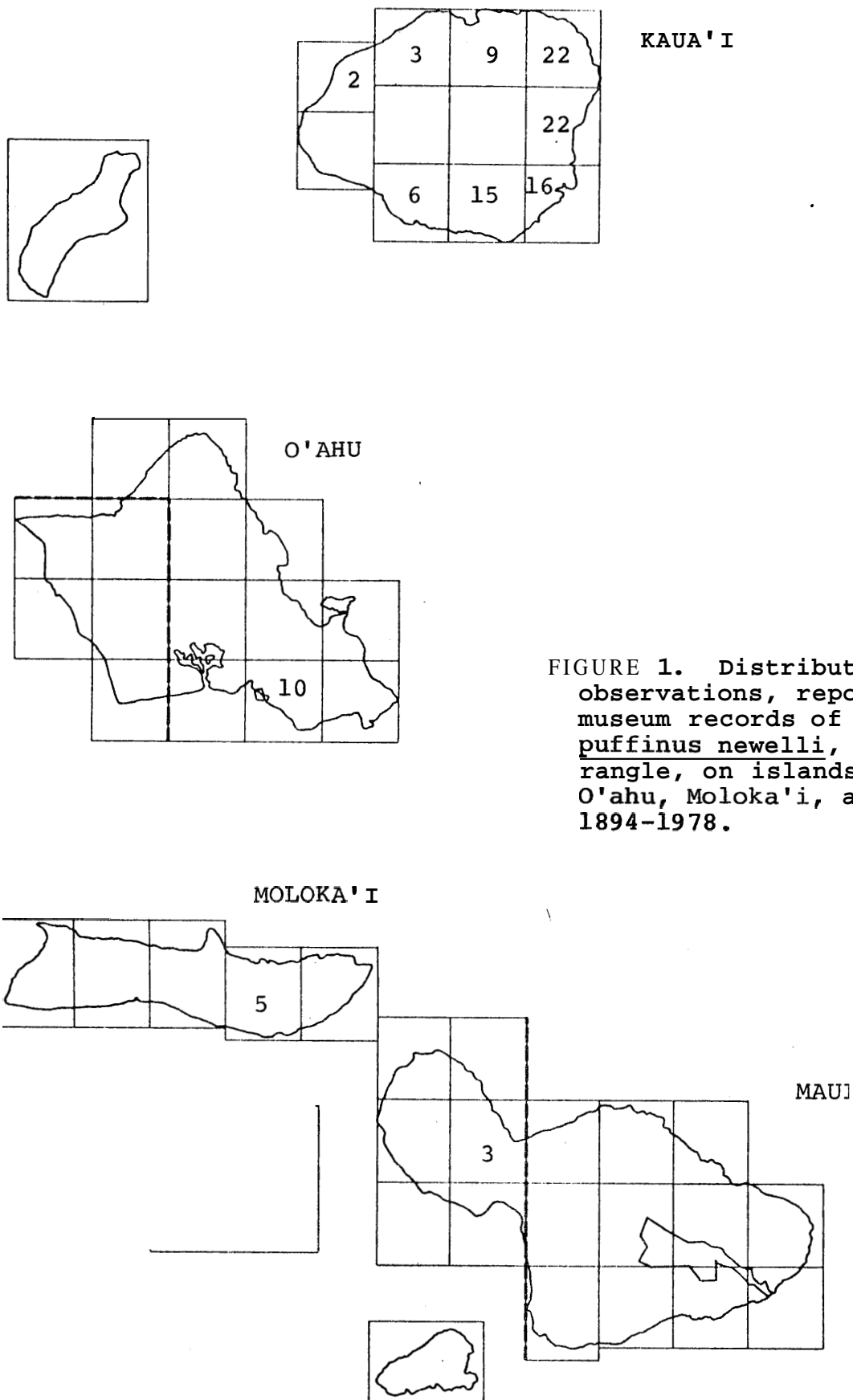


FIGURE 1. Distribution of observations, reports, and museum records of *Puffinus puffinus newelli*, per quadrangle, on islands of Kaua'i, O'ahu, Moloka'i, and Maui, 1894-1978.

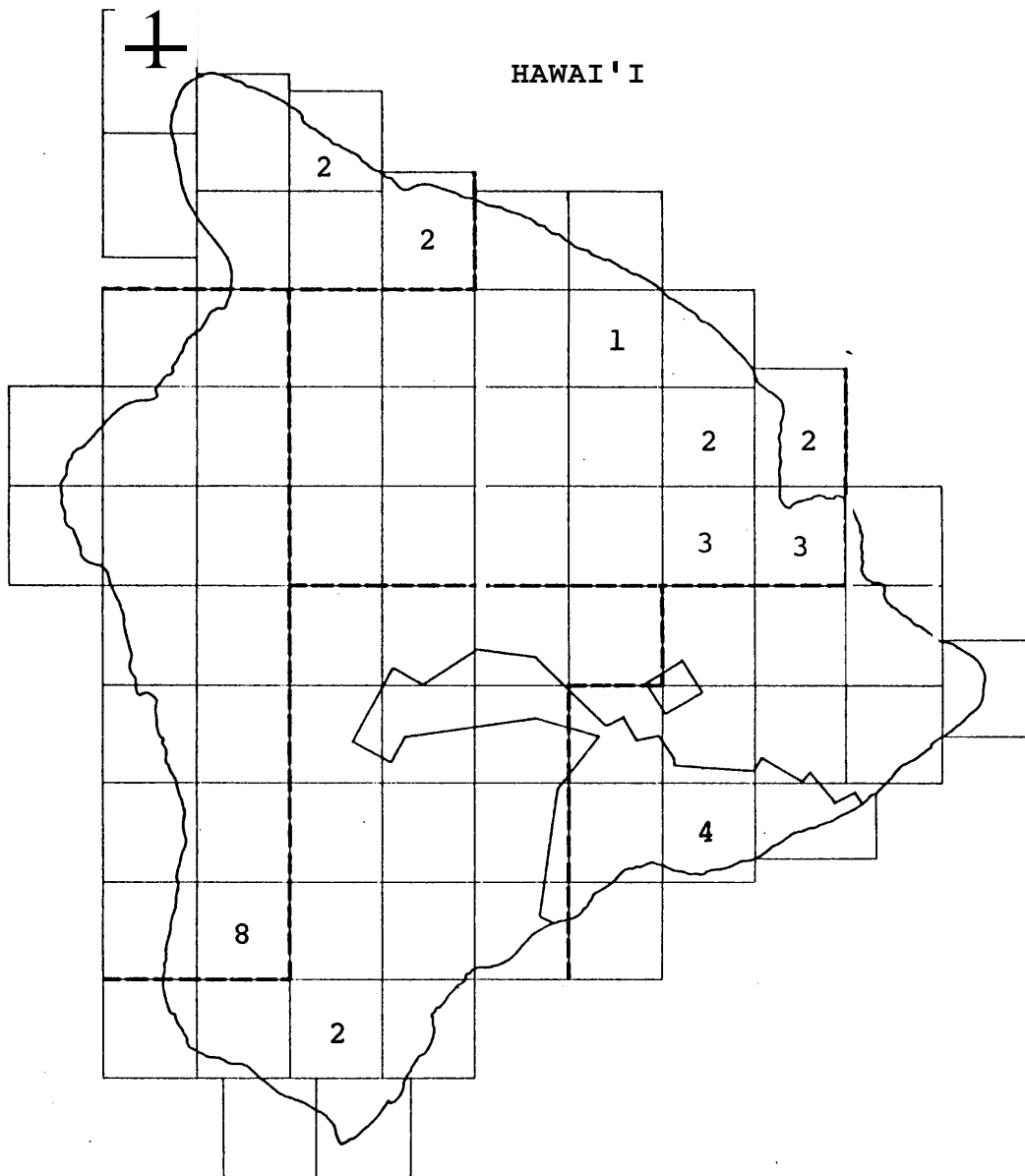


FIGURE 2. Distribution of observations, reports, and museum records of Puffinus puffinus newelli, per quadrangle, on Island of Hawai'i, 1894-1978.

leading to a 1966 population estimate of at least low thousands present on Kaua'i. Night-flying 'A'o continued to crash on Kaua'i in the vicinity of bright lights every year from 1960 until 1977, the last complete year of literature monitoring. Estimates of 'A'o which die annually after crashing range from low to mid-hundreds; as many as 200 have been picked up around a single light source in a three week period. Basic cause of crashing appears to be lack of energy resources with bright lights having a possible contributory effect. Total population appears to be declining as a result of crashing.

On O'ahu, 14 fallen 'A'o have been picked up in 22 years, from 1954 to 1975, chiefly near brightly-lit Pali tunnels.

On Moloka'i, 'A'o bred on the precipitous, heavily vegetated valleys of Pelekunu and Wailau at the eastern end of the island during the 1890's. As late as 1907 their young were collected in considerable numbers by the natives for food. No 'A'o have been reported from Moloka'i for 72 years, since 1907.

On Maui, 'A'o were reported numerous at Waihe'e Valley in 1894. The status of the Waihe'e colony was termed doubtful in 1902, though 'A'o were still observed to be numerous in the channel between Maui and Moloka'i at that time. No 'A'o have been reported on Maui or in the immediate surrounding waters for 85 years, since 1894.

On Hawai'i, 'A'o were reportedly taken by natives for food around the turn of the century at Waipi'o Valley, and may have occurred in numbers before ca. 1890 at Pali Puaao, near Wai'ōhinu, Ka'ū. No 'A'o seem to have been reported from the island of Hawai'i from ca. 1900 to 1970. In 1970, 1971, and 1972, night-calling 'A'o were reported on occasion from May to September in Pāpā and Honomalino, South Kona, but their numbers were reported to have declined in recent years. Indications of a small breeding colony of 'A'o were discovered in 1972 at Makao-puhi Crater, Hawaii Volcanoes National Park, small numbers having been seen seaward of Kalapana in 1970, and more recently again in 1975. There are 11 reports of 'A'o along the Hāmākua Coast from 1970 to 1978, some of night-calling birds and some of fallen individuals picked up after crashing at night in various lighted areas along the Hāmākua Coast, from Hilo to Laupahoehoe. Night-calling birds were recently heard at two locations in the windward Kohala Mountains, previous surveys along the crest of the mountains having been negative.

There seem to be no records of 'A'o on Lāna'i, Kaho'olawe, or Ni'ihau, the small islets offshore of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i, or on the Northwestern Hawaiian Islands.

'A'o normally range at sea up to 200 miles of the Hawaiian Islands during their May to October breeding season. Wintering grounds of the 'A'o are unknown,

Extra-limital breeding season records of 'A'o exist for the Mariana Islands, Wake Atoll, and Johnston Atoll.

CONCLUSIONS

Substantial breeding colonies of 'A'o are known historically from Waipi'o, Kohala, and possibly from Pali Puaao, Ka'ū, Hawai'i; Waihe'e, Maui; Wailau and Pelekunu, Moloka'i; and Makaleha, Kaua'i. Only a small fraction of the numbers present in the Islands during the historic period exist today. The proportion now extant may actually be even less than is now apparent as many colonies were being heavily exploited by natives for food in the late 1800's while existence of other populations was doubtlessly never recorded. The lack of many crashed individuals in other than already known or suspected breeding localities does not encourage hope that substantial populations remain to be discovered. Though contemporary field work may result in finding a few individuals breeding at old colony sites, or scattered populations not now known may be discovered, especially on Hawai'i and Kaua'i, the future of 'A'o in the Hawaiian Islands cannot be viewed with optimism if the comparatively large viable population on Kaua'i continues to decline.

OBSERVERS

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APPENDIX I

1. Observations, reports, and specimen records are organized by island group, island, district, and/or quadrangle map. Order of listing, names and locations of district, and quadrangle boundaries are explained and illustrated in CPSU/UH Avian History Report 4: Introduction to Part I, Population Histories--Species Accounts.
 2. Acronyms composed of the first three letters of the author's (or senior author's) last name, the initial letter of the first name, and last two digits of the year of publication represent sources found in the bibliography under References Cited. For example, BRYW01 = Bryan, W. A., and Alvin Seale. 1901. Notes on the birds of Kauai. Bishop Museum Occ. Papers. 1(3): 129-137. In cases where it is necessary to distinguish between two or more articles published by an author in any given year, letters are added to the acronym in alphabetical sequence, e.g., BRYW01a = Bryan, W. A. 1901. A key to the birds of the Hawaiian group. Bishop Museum Press, 76 pp.
- Parenthetical numbers such as (5), represent references listed under Unpublished Sources Cited in the bibliography.
3. Place-names are cited in original form.
 4. Parenthetical information is qualified.

Relative Abundance/Locality	Elev. (ft.)	Date	Source
Southeastern Hawaiian Islands			
ISLANDS-WIDE INFERENCE			
1 numerous / on Maui...also on Kauai (W. A. Bryan)...and...may prove to be some- what generally dispersed throughout the group	(1902)	HENH02
2 occurs / on Kauai, Maui, Molokai, and prob- ably the other islands, where there are deep valleys with precipitous sides	(1903)	PERR03
3 in danger of extinction...formerly common / Hawaii, Maui, Molokai, Kauai and probably on other smaller islands	(1944)	MUNG64
Island of Kaua'i			
ISLAND-WIDE INFERENCE			
4 specimen obtained / lives at lower eleva- tions...than does the 'Ua'u...even when they are found in the same cliffs. The 'A'o keep to themselves in the lower part and the 'Ua'u to themselves higher up	April (1915)	BRYW15
5 Swedberg: large numbers picked up and released by interested individuals and members of the Humane Society	Oct. 1965	(5)
6 King: heard birds calling / in all the valleys we have checked at night during the breeding season, and we suspect.. .moderate numbers in most of the valleys	(1963-1965)	KINW67

- | | | | | |
|----|--|------|---|--------|
| 7 | King: guess a population at least in the low thousands indicated from pelagic observations | .... | (30 Sept. 1966) | (5) |
| 8 | Swedberg: period of falling birds.. .most found near brilliant light source of some kind | .... | begins in Sept., peaks in Oct., extends thru Nov. (6 Oct. 1966) | (5) |
| 9 | Swedberg: 200 or more found | .... | during 5 year period, 1962-1966 | (5) |
| 10 | making their annual landing / dropping exhausted on roads and parking lots | .... | (Oct. 1967) | ANON68 |
| 11 | Telfer: assume falling 'A'o is relatively recent...would guess that in the six years I've been here we have had between 300-500 fallen shearwaters die as a result of being struck by cars, or killed by dogs or cats, or of shock | | (1968-1973)
(15 Feb. 1974) | (5) |
| 12 | Telfer: occurrence of fallen 'A'o reaches a peak just before they leave the nesting grounds in October.. .would say that 80% that fall do so at that time of year...many immatures but.. .others adults | | (1968-1973)
(15 Feb. 1974) | (5) |
| 13 | Telfer: Sincock banded several hundred the first year I was here (1967)...to my knowledge no recoveries have been made | .... | (15 Feb. 1974) | (5) |
| 14 | Telfer: at times may get as many as five or six telephone calls a day from residents who find them...kept little written records on fallen birds since they became so common | .... | (1 Mar. 1974) | (5) |
| 15 | Telfer: both John Sincock and I feel that the population must be decreasing.. .numbers seen falling has tapered off in the Past few years...cannot give any statistical facts.., | .... | (1 Mar. 1974) | (5) |

Island of Kaua'i--(Continued)

UNDESIGNATED LOCALITY

16	Gay: 4 specimens taken	....	before 1891	KINW67
17	Gay: lays eggs in the earth near the sea	....	(10 Mar. 1891)	MUNG41
18	Gay: fairly common / in certain cliffs in the mountains	....	(1900)	BRYW01
19	Munro: took specimen	....	11 May 1956	KINW67
20	fair-sized breeding population indicated / presumably back in the mountains...found no clues as to its whereabouts	....	Summer 1960	RICF64
21	Swedberg: two picked up from the highway... six others observed dead...Kauai biologist observed one to fall directly out of sky... no wires or other obstacle present.. tumbled down as if shot...exhausted	....	Oct. 1962	(5)
22	Swedberg: 2 downed, banded and released	....	Oct. 1962	KINW67
23	Swedberg: one found exhausted	....	Nov. 1963	KINW67
24	Swedberg: one autopsied by State veterinarian.. found no lesions...emaciation noted by absence of fat on the heart	....	Nov. 1963	(5)
25	Swedberg: took specimen	....	25 Sept. 1964	KINW67
26	Swedberg: took 5 specimens	....	Oct. 1964	KINW67
27	Swedberg: one dead	....	Nov. 1964	KINW67
28	Swedberg: one autopsied by Miyahara (DVM): shortage of food most probable cause of death	....	(12) Nov. 1964	(5)
29	took specimen	....	6 May 1965	KINW67

30	one specimen previously unreported / Kokee Museum, Kokee (locality taken undesignated)	....	Jan. 1967	KINW67
31	first kills noted / along highways	....	25 April 1975	ZEIF75a
32	thought to number in low thousands / restricted to an isolated part of Kauai	....	(1975)	USFW75
33	first road kill / along the highway	....	8 May 1977	PYLR78a

MULTIQUADRANGLE

34	4 found dead / along the main eastern coastal highway	....	(June-Aug. 1960)	RICF64
35	occurs in moderate numbers, probably nightly in the summer / along much of east coast	....	(June-Aug. 1960)	RICF64
36	probably heard / along Na Pali coast	....	(June-Aug. 1960)	RICF64
37	Hadley: large numbers observed and reported (as 'Ua'u) / grounded along the windward beaches	....	Summer 1960	WARR68
38	large numbers observed and reported (as 'Ua'u) / grounded along the windward beaches	....	Summer 1961	WARR68
39	9 recorded / Na Pali Coast	....	(1963-1965)	KINW67
40	Telfer: have picked up injured ones / in all low elevation areas of the island except Na Pali coast; predominate where street and building lights are most concentrated	....	(1968-1973) (15 Feb. 1974)	(5)
41	Telfer: have heard flying at night / most points along the Kauai coastline	....	(1968-1973)	(5)
42	Telfer: 12 specimens salvaged / Hanalei, Hanapepe, Lihue, Wailua, Kilauea (Point), and undesignated localities	....	July, Sept., Oct., 1974	(6)

Island of Kaua'i--(Continued)

MAKAHA POINT

43	2 alive / Kokee Radar Tracking Station	Fall 1964	KINW67	20
44	Telfer: heard during goat census work / Nualolo Aina valley on the Na Pali Coast	each May (1968-1973)	(5)	

HAENA

45	one heard / Hanakoa Valley, Na Pali Coast	....	6 April 1965	KINW67
46	heard two / Waiahuakua Valley	....	6-8 Aug. 1965	DONW65
47	heard about 5 / Kalalau Valley	....	(1963-1965)	KINW67

HANAIEI

48	evening flights / Hanalei area	....	4-8 Sept. 1963	ORDW63
49	one specimen / Hanalei Plantation Hotel	....	6 July 1964	KINW67
50	took specimen / Hanalei Plantation Hotel	....	8 July 1964	KINW67
51	16 banded and released / Hanalei Plantation Hotel (and Kilauea Point)	....	29 Oct. 1964	KINW67
52	several recorded / Hanalei	....	(1963-1965)	KINW67
53	10 recorded / Hanalei Plantation Hotel	....	(1963-1965)	KINW67
54	25 banded and released / Hanalei Plantation Hotel and Kilauea Point	....	(1963-1965)	KINW67
55	total of 51 seen in continuous watch...by two observers...6x20 binoculars...focused westward / across Hanalei Bay from Hanalei Plantation to Kolokolo Point / 1840-1945 hours	....	28 July 1972	DOUR72

56	Telfer: located nesting colony / on Keanaawi Ridge in the upper Hanalei River drainage	(1968-1973)	(5)
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ANAHOLO

57	adult with chick found...in two burrows / Kilauea Lighthouse cliffs	8 Sept. 1946	PEAG47
58	unsuccessful search.. .in spite of careful searching and constant alertness / Coast Guard Station, Kilauea Pt.	....	night of 5 July (1947) early a.m. 6 July	FENC47
59	Bowles: took specimen / Kilauea	....	5 Nov. 1956	KINW67
60	16 banded and released / Kilauea Point (and Hanalei Plantation Hotel)	....	29 Oct. 1964	KINW67
61	took 2 specimens / Kilauea Point	....	29 Oct. 1964	KINW67
62	Swedberg: one (found) / Kilauea (Point)	....	April 1965	KINW67
63	took 3 specimens / Kilauea Point	....	4 May 1965	KINW67
64	43 recorded / Kilauea Point	....	(1963-1965)	KINW67
65	Bulmer: one noted flying inland...at dusk / over Kilauea Point	....	1 July 1966	(7)
66	three banded and released / Kilauea Point	....	2 Nov. 1966	KINW67
67	Sincock and Swedberg: heard possibly more than 500; found 30 nesting burrows; 6 nestlings, 14 adults banded; heavy uluhe ground cover / ridge of the Makaleha Mountains Moloaa Forest Reserve; could see bridge on State Route 56 crossing Moloaa Stream	1500	25 July; 1-4, 28-29 Aug. 1967	SINJ69
68	found...at dusk...flying from the sea toward the mountain ridges / (Kilauea Lighthouse?)	....	3-13 July 1970	KAIC70
69	one seen / Kilauea Lighthouse	....	18 Aug. 1971	HANR75

Island of Kaua'i--(Continued)

ANAHOE (con't ,)

70	Telfer: received reports from pig hunters of pig stomachs full of Newell's shearwater remains, ..pig meat unpalatable because of "fishy" smell / in the Kilauea area	....	15 Feb, 1974	(5)
71	much calling after dark / in Anahola Mtns. near Highway 56 (Moloaa)	....	after 11 May 1975	ZEIF75a
72	several heard and observed / along north shore after dark	....	June 1975	ZEIF75a
73	one calling at dusk / Kilauea Point	....	29 April 1977	PYLR78
74	heard about 25 / Waimea Canyon	....	5-6 Aug. 1964	KINW67
75	one heard / Waimea Canyon Lookout	....	7 April 1965	KINW67
76	about 25 heard / Waimea Canyon Lookout	....	1 May 1965	KINW67
77	King: listened at 8:30...about as numerous as yesterday / Waimea Canyon	....	2 May 1965	(8)
78	25 recorded / Waimea Canyon	....	(1963-1965)	KINW67

KAPAA

79	one picked up / on the beach near Kapaa	....	first part of Oct., 1956	ANON56
80	Richardson: obtained specimen / Kapaa	....	24 June 1960	(6)
81	specimen taken / Wailua	....	31 July 1960	KINW67
82	one picked up / Wailua bridge	....	31 July 1960	(6)
83	one found dead / on the beach near Kapaa	....	(June-Aug, 1960)	RICF64

84	one to six observed...just before dark on a number of nights.. flying high overhead / along the coast near Kapaa or heading inland toward the mountains	....	(June-Aug. 1960)	RICF64
85	counted a total of 48 shattered birds within ..five miles.. never such a slaughter as there was last month...eight under one of those street lamps at plantation road crossings.. counted ten more within a hundred yards / on the highway skirting the shoreline between Kealia and the Wailua river	....	late Oct. 1960	HADT61
86	Swedberg: 47 downed / Wailua	....	Sept. 1962	KINW67
87	Swedberg: two dead / Wailua	....	11 Oct. 1964	KINW67
88	Swedberg: eleven dead / Wailua (Coco Palms)	....	21-23 Oct. 1965	KINW67
89	took specimen / Wailua	....	30 Oct. 1964	KINW67
90	one live / Wailua	....	30 Oct. 1964	KINW67
91	Swedberg: found one dead / on highway 1 mile towards Kapaa from Coco Palms bridge	....	13 Oct. 1964	(5)
92	Swedberg: one live / Wailua	....	13 Oct. 1964	KINW67
93	Swedberg: heard calling regularly / near the Sleeping Giant.. may prove to be a nesting area	....	July 1965	(5)
94	Swedberg: several / Wailua (and Lawai)	....	July 1965	KINW67
95	Swedberg: one dead / Hanamaulu	...	18 Oct. 1965	KINW67
96	Swedberg: one dead / Nonou Mountain	....	4 Nov. 1965	KINW67
97	Swedberg: one dead / Wailua	....	(1963-1965)	KINW67

Island of Kaua'i--(Continued)

KAPAA (con't.)

98	123 recorded / Kealia to Wailua	....	(1963-1965)	KINW67
99	Swedberg: one dead / Wailua (Coco Palms)	....	7 Oct. 1965	KINW67
100	dead birds especially concentrated / along highways at Kealia and Wailua River bridge and Eleele	....	June-Aug. 1975	ZEIF75b

HANAPEPE

101	Swedberg: one dead on road / near Port Allen	....	Fall of 1961	(5)
102	took specimen / Hanapepe	....	25 Oct. 1964	KINW67
103	one dead / Hanapepe	....	25 Oct. 1964	KINW67
1104	Swedberg: one live / Eleele	....	8 Nov. 1965	KINW67
105	2 recorded / Eleele - Hanapepe	....	(1963-1965)	KINW67
106	dead birds especially concentrated / along highways at Eleele (and Kealia and Wailua River bridge)	....	June-Aug. 1975	ZEIF75b

KOLOA

107	Munro: obtained specimen / Koloa	....	8 Oct. 1956	(6)
108	Fuller: found burrows and dead 'A'o not too far away / Mahalepu area	....	number of years ago (17 Sept. 1964)	(5)
109	Swedberg: one picked up alive, died later, specimen / Kalaheo	....	21 Sept, 1964	KINW67
110	Swedberg: one live / Lawai	....	14 Nov. 1964	KINW67

111	one live / Lawai	....	23 April 1965	KINW67
112	Swedberg: one found / Lawai cannery road	....	April 1965	(5)
113	Swedberg: several / Lawai (and Wailua)	....	July 1965	KINW67
114	Swedberg: two dead / Lawai - Koloa Road	....	5 Nov. 1965	KINW67
115	Swedberg: two dead / Lawai - Koloa Road	....	22 Nov. 1965	KINW67
116	12 recorded / Koloa - Lawai	....	(1963-1965)	KINW67
117	Swedberg: one reported on road / between Lawai and Koloa	....	July 1965	(5)
118	Swedberg: one dead / Lawai - Koloa Road	....	(1963-1965)	KINW67
119	Swedberg: one / Lawai	....	(1963-1965)	KINW67
126	dozen captured, others seen / Kauai Surf (hotel)	....	5 Nov. (1967)	DONW68
121	Telfer: located nesting colony / about 1 mile E of Alexander Dam above Kalaheo	....	(1968-1973)	(5)

LIHUE

122	Swedberg: found two dead / on highway 1 mile past Kauai Inn on road to Nawiliwili	....	12 Oct. 1964	(5)
123	Swedberg: one live / Lihue	....	19 Oct. 1964	KINW67
124	took specimen / Lihue	....	25 Oct. 1964	KINW67
125	Swedberg: one live / Lihue	....	16 Oct. 1965	KINW67
126	Swedberg: one found alive, two dead / Lihue Mill area	....	4 Nov. 1965	(5)
127	Swedberg: two found alive, Lihue	....	5 Nov. 1965	(5)

Island of Kaua'i--(Continued)

LIHUE (con't ,)

128	Swedberg: one live / Lihue	....	(1963-1965)	KINW67
129	Swedberg: two dead / Lihue	....	(1963-1965)	KINW67
130	one dead / Lihue	....	(1963-1965)	KINW67
131	Swedberg: two live / Lihue	....	(1963-1965)	KINW67
132	14 recorded / Lihue	....	(1963-1965)	KINW67
133	one dead / Lihue (?)	....	(1963-1965)	KINW67
134	Doepping picked up 125 / Kauai Surf Hotel, Lihue	....	22 Oct.-3 Nov. 1967	SINJ69
135	Doepping picked up 75 / Kauai Surf Hotel, Lihue	....	4-11 Nov. 1967	SINJ69
136	one found dead / on the highway near the airport	....	3-13 July 1970	KAIC70
137	Telfer: suspect nesting / in the Haupu mountain range S of Lihue	....	(1968-1973)	(5)

Island of O'ahu

Ko'olau

HONOLULU

138	adult specimen picked up 4 a.m. / flew into a room of a sugar refinery near Aiea	....	22 May 1954	RICF55
139	one found in an open area,, evidently blown in by hurricane Dot / Honolulu Airport	....	7 Aug. 1959	HATG59

140	one picked up in an exhausted condition / in the parking lot of the Donald Duck Drive-In at 2840 Kapiolani Blvd., Honolulu	....	3 July 1961	CARR62
141	Bowles: took specimen / Honolulu	....	3 July 1961	KINW67
142	Swedberg: found dead birds, one each night / near the Pali tunnel	....	4 Aug. 1967 9 Sept. 1967 19 Nov. 1967 25 Nov. 1967 27 Nov. 1967	SINJ69
143	picked one up / Edgewater Hotel, Waikiki	....	6 June 1968	SWEG68
144	Kridler: Olsen found one dead / near the Pali tunnel	....	26 May 1971	(3)
145	Swedberg: picked up one dead / entrance of first tunnel on Honolulu side of Pali Highway	....	4 Sept. 1972	(4)
145a	Conant: Gagne collected one / near Farrington High School	....	1973-1975	(14)
145b	Conant: Pratt picked one up / Kailua side of Pali tunnel	....	?1975	(14)

Island of Moloka'i

KAMALO

146	several dead and partially decayed specimens found some days after a severe storm / at the head of one of the deep valleys of windward Molokai	....	(1893, 1896)	PERR03
147	specimen collected some years before / one of the steep cliffs toward the summit of the mountain between Pelekunu and Waikolu valleys	....	(1907)	BRYW08

Island of Moloka'i--(Continued)

KAMALO (con't.)

- | | | | | |
|-----|--|-------------|-----------------|--------|
| 148 | natives informed me...adults and young can be collected in considerable numbers / from the cliffs (Pelekunu)...in the steepest parts of the pali | (500-1000+) | (1907) | BRYW08 |
| 149 | occasionally...found in same colony - on rare occasions in the same hole (as 'Ua'u) / (Pelekunu area) | .... | (1907) | BRYW08 |
| 150 | heard call several times...much rarer (than 'Ua'u) / Wailau and Pelekunu valleys | .... | (May-June 1907) | BRYW08 |

Island of Maui

West Maui

WAILUKU

- | | | | | |
|-----|--|------|----------------|--------|
| 151 | type specimen and several others obtained by natives / Waihee Valley | .... | Spring of 1894 | HENH00 |
| 152 | numerous / in the Waihee valley and probably elsewhere on Maui | .... | 1894 | HENH02 |
| 153 | present status doubtful | .... | (1900) | HENH00 |

Island of Hawai'i

Kohala

MONOKANE

- | | | | | |
|-----|--|------|-------------|--------|
| 154 | heard persistent night calling, tentatively identified as 'A'o / new USGS camp | 3000 | 7 Aug. 1977 | HALJ78 |
|-----|--|------|-------------|--------|

155	Kepler, Jeffrey, Scott: Collins: heard calling / Waimanu (valley)	13-15 Sept. 1977	(12)
-----	---	------	------------------	------

KAWAIHAE

156	Banko: listened for an hour or two after dark.. .very windy.. .heard nothing / at camp-site near forest S of Puu Pili, Kahua Ranch	4000	20 May 1968	(1)
157	Banko: Richards (resident since 1955): never seen or heard / Kahua Ranch	4000	21 May 1968	(1)
158	Banko: Wall (resident since 1955): never seen or heard / Kahua Ranch	4000	21 May 1968	(1)
159	Banko: listened for an hour or two after dark...none heard / camp near water gauge Puu Laalaau, head of West Branch Honokane Nui, N end of Kohala Mountains	3840	21 May 1968	(1)

KAMUELA

160	Banko: none heard 1930-2040 hours / Forest Road overlooking Waipio Valley 4 miles N of Kamuela	11 Aug. 1967	(1)
-----	--	------	--------------	-----

KUKUIHAELE

161	used to nest...natives used for food / Waipio Valley	....	(early 1900's?)	MUNG64
162	Banko: Meinecke: Moi reported 'A'o formerly eaten (before 1898) / Waipio Valley	....	(17 July 1968)	(1)

Island of Hawai'i--(Continued)

Kona

W
O

PAPA

163	Banko: Schattauer picked one up alive after it struck TV antenna on residence at 1945 hours / residence at Honomalino Agricultural Hdqs., 4 miles S Papa (village)	1600	25 Aug. 1970	(1)
164	Banko: Schattauer identified calls of 'A'o (from tape recording) as those of night calling birds heard in recent years, especially before circa 1966, declining since then / residence at Honomalino Agricultural Hdqs., 4 miles S Papa	1600	9 Nov. 1970	(1)
165	Banko: Schattauer: night calling reported by Johannsen / Papa	....	24 May 1971	(1)
166	Banko: Schattauer heard several times.. around 2130 and 0430 hours...first time this year / Honomalino Agricultural Hdqs., 4 miles S Papa	1600	25 May-2 June 1971	(1)
167	Banko: Schattauer heard first time this year / Honomalino Agricultural Hdqs., 4 miles S Papa	1600	1 June 1972	(1)
168	Banko: Schattauer: reported heard by Johannsen and wife / Papa	....	2 June 1972	(1)
169	Banko: Schattauer heard going mauka / Honomalino Agricultural Hdqs., 4 miles S Papa	1600	6 June 1972	(1)
170	Banko: Schattauer: Mrs. Johannsen reported night calling of flocks passing over / Papa	....	5 Sept. 1972	(1)

Ka'u

KAHUKU RANCH

- | | | | | |
|-----|---|------|-----------------|--------|
| 171 | Banko: Meinecke (born 1886 in Waiohinu) :
night calling of petrels occasionally heard
(from birds presumably nesting at nearby
Pali Puaao) (old timers told Meinecke about
1894 'A'o nested in numbers at Pali Puaao
before collapse in great 1868 earthquake...
however Meinecke accurately imitated call of
'Ua'u and was not familiar with appearance
of either species - therefor 'Ua'u possibly
nested at Pali Puaao exclusively or in con-
junction with 'A'o / Waiohinu (NAALEHU QUAD.) | | (17 July 1968) | (1) |
| 172 | Meinecke: straggler used to come / Puuao
(cliff) | | (early 1900's?) | MUNG64 |

Hawaii Volcanoes National Park

MAKAOPUHI CRATER

- | | | | | |
|-----|--|-------|--------------|------|
| 173 | USGS field party found fresh carcass with
egg / N wall Makaopuhi Crater, near mezzanine
level | 3000- | 4 Aug. 1972 | (1) |
| 174 | Laybourne: confirmed seabird carcass
found dead with egg 4 Aug. 1972 as that of
P. p. newelli / N wall Makaopuhi Crater, near
mezzanine level | | 7 Sept. 1972 | (13) |
| 175 | Banko: calls heard twice...1930 and 2055
hours / camped on mezzanine near N wall
Makaopuhi Crater | 3000- | 8 Sept. 1972 | (1) |

Island of Hawai'i--(Continued)

MAKAOPUHI CRATER (con't.)

- | | | | | | |
|------|--|------|-------------|-----|---|
| 176 | Baldwin: seems very reasonable to me that population found in 1972 may be a relict group possibly present in 1940's / Makaopuhi Crater | | 1940's | (2) | 2 |
| 176a | Banko: none heard in listening survey from dark to 2030 hours . . . drizzling rain / SE rim Makaopuhi Crater | 3000 | 6 Aug. 1978 | (1) | |

Mauna Mea

KEANAKOLU

- | | | | | |
|-----|---|------|-----------|--------|
| 177 | Kepler, Jeffrey, Scott: Shallenberger: found dead adult on road / Laupahoehoe | | Aug. 1976 | KEPC79 |
|-----|---|------|-----------|--------|

AKWKA FALLS

- | | | | | |
|-----|---|------|--------------|--------|
| 178 | Kepler, Jeffrey, Scott: Jeffrey: three flew from the woods / near Kauku Crater, only 4 miles from Papaiko-Pepeekeo Hill sightings | .... | 1976 | KEPC79 |
| 179 | Kepler, Jeffrey, Scott: Taylor and Wshman: heard flying 0450 hours / down the Hakalau River | 2110 | 21 Aug. 1977 | KEPC79 |

PAPAIKOU

- | | | | | |
|-----|---|------|--------------|--------|
| 180 | Kepler, Jeffrey, Scott: Jeffrey: saw flying, around powerful night lights on sugar cane loading crane.. captured , identified and released / Papaikou | .... | 13 July 1977 | KEPC79 |
| 181 | Kepler, Jeffrey, Scott: Jeffrey: saw two flocks (ca. 2-3 birds)...also attracted to crane lights / 0.5 mile S of Pepeekeo Hill | .... | 13 July 1977 | KEPC79 |

PIIHONUA

- | | | | | |
|-----|---|------|--------------|--------|
| 182 | Banko: one picked up alive after it hit
cane harvesting light boom / near Camp 4,
Piiahonua (above Hilo Hospital) | | 26 May 1968 | (1) |
| 183 | Kepler, Jeffrey, Scott: heard only once by
USFWS survey crew while conducting forest
bird surveys / Wailuku River | | (1977) | (12) |
| 184 | Kepler, Jeffrey, Scott: Davis: heard
calling 2030 hours / near the Awehi River | 1640 | 13 July 1977 | KEPC79 |

HILO

- | | | | | |
|------|--|------|-------------|------|
| 185 | Banko: Kosaka picked one up / junction of
Lanikaula and Kilauea Streets, Hilo | | 5 June 1970 | (1) |
| 186 | Banko: Kosaka picked one up / Naniloa Hotel,
Hilo | | 1 July 1970 | (1) |
| 186a | S. Conant picked up road kill / 287 Kaumana
Drive, Hilo | | 4 July 1978 | (11) |

At Sea

- | | | | | |
|-----|---|------|-----------------|--------|
| 187 | noted / in sight of Kauai | .... | 14 Aug. 1891 | MUNG64 |
| 188 | numerous / channel between islands of
Molokai and Maui | | (1902) | HENH02 |
| 189 | Fisher: observed three / flying in the
channel between Kauai and Niihau | | 11-17 Aug. 1947 | FISH51 |
| 190 | Banko: 17 specimens collected / at sea
during surveys of Pacific Ocean Biological
Survey Program, Smithsonian Institution | | 1963-1966 | (6) |

At Sea--(Continued)

191	King: Crossin saw 'A'o in company with 'Ua'u early in the morning / close to southern shore of Kauai...during surveys of Pacific Ocean Biological Survey Program, Smithsonian Institution	....	(1965-1966)	(9)
192	common at sea / within 200 miles of the main Hawaiian Islands	....	May-Oct. (1964-1965)	KINW70
193	most birds / either fairly close to the Hawaiian Islands or at the southern edge of the study area (between about 10°-27° N lat. and 148°-158° W long.)	....	May (1964-1965)	KINW70
194	has been recorded (at sea) / up to 800 miles of the main Hawaiian Islands	....	(1964-1965)	KINW70
195	two density centers noted (from 3,561 hours of observation on 15 cruises along 34,384 mile replicate sampling track) / one within 200 miles of the Hawaiian Islands, especially N of Oahu, and one at the southern end of the (500,000 sq. mile) study area below lat. 14° N	....	(1964-1965)	KINW70
196	migrates / presumably to south and west	....	in Oct. (1964-1965)	KINW70
197	nearly absent / from the Hawaiian (Islands) area	....	all winter (1964-1965)	KINW70
198	wintering area / unknown	....	(1964-1965)	KINW70
199	Banko: Larson saw two the past 2 or 3 days / near National Park Service residences, Kalapana, Hawaii Volcanoes National Park	....	14 April 1970	(1)
200	Yutzy & Yutzy: 3 observed offshore through 20x telescope-10x binoculars / near Wahaula Visitor Center, Hawaii Volcanoes National Park (1220 hours)	7 Aug. 1975	(10)

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| 201 | Yutzy & Yutzy: 1 observed offshore through 20x telescope-10x binoculars / near Harry K. Brown Beach, 4 miles NE of Wahaula Visitor Center, Hawaii Volcanoes National Park (1430 hours) | | 7 Aug. 1975 | (10) |
| 202 | Yutzy & Yutzy: 1 observed offshore through 20x telescope and 10x binoculars near Kamoamoa, Hawaii Volcanoes National Park (1412 hours) | | 13 Aug. 1975 | (10) |

Extra-Limital

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|-----|--|------|--------------|-------|
| 203 | specimen taken / on Saipan...Mariannas Archipelago | | May 1887 | JOU56 |
| 204 | Banko: specimen obtained / Kuku Point, Wilkes Island, Wake Atoll | | 15 June 1966 | (6) |
| 205 | Banko: specimen obtained / Sand Island, Johnston Atoll | .... | 21 Aug. 1963 | (6) |